UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/572,524	09/11/2007	Xuejun Kang	7989P001	4739

8791 7590 09/16/2010

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER	
JOY, JEREMY J	

ART UNIT	PAPER NUMBER
2822	

MAIL DATE	DELIVERY MODE
09/16/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/572,524	KANG ET AL.	
	Examiner	Art Unit	
	Jeremy J. Joy	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06/30/2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,9,10,12,14-16,18-21,23-31,34-36, 38-48, and 50-57* is/are pending in the application.

4a) Of the above claim(s) *1-6,9,10,12,14-16,18-21,23-28,47 and 48* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *29-31, 34-36, 38-46, and 50-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/01/2010, 08/09/2010*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment to the claims filed on 06/30/2010 has been acknowledged and entered. Claims 32-33 have been cancelled and new claims 52-57 have been added. Action on the merits is as follows:

Double Patenting

2. Applicant is advised that should claim 29 be found allowable, claim 50 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. The term "relatively" in claims **29-31, 41, 50 and 52** is a relative term which renders the claim indefinite. The term "relatively" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one

of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims **29-31, 34-36, 38-39, and 50-57** are rejected under 35 U.S.C. 103(a) as being unpatentable over *Lee et al.* (**U.S. Patent Pub. No. 2003/0189215**, from hereinafter "*Lee*") in view of *Held* (**U.S. Patent Pub. No. 6,509,270**).

Regarding Claim 29 and 50, *Lee* teaches a light emitting diode having multiple epitaxial layers and a first ohmic contact layer formed on the epitaxial layers remote from the substrate; a suitable metal coated on the first ohmic contact layer and a relatively thick layer of thermally conductive metal electroplated on the suitable metal layer, wherein the substrate is removed, but fails to specifically teach the suitable metal is a seed layer formed of the thermally conductive metal (Fig. 15, substrate 122, epitaxial layers 124/126/128, first ohmic contact 150, thick layer 156; ¶ 0031-0050).

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee* to include a seed layer formed on the first ohmic contact of the thermally conductive material because the seed layer helps with reliability of the relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 30, *Lee* teaches a laser diode having multiple epitaxial layers and a first ohmic contact layer formed on the epitaxial layers remote from the substrate; a suitable metal coated on the first ohmic contact layer and a relatively thick layer of thermally conductive metal electroplated on the suitable metal layer, wherein the substrate is removed, but fails to specifically teach the suitable metal is a seed layer formed of the thermally conductive metal (Fig. 15, substrate 122, epitaxial layers 124/126/128, first ohmic contact 150, thick layer 156; ¶ 0031-0050).

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee* to include a seed layer formed on the first ohmic contact of the thermally conductive material because the seed layer helps with reliability of the relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 31, *Lee* teaches a light emitting diode having multiple epitaxial layers and a first ohmic contact layer formed on the epitaxial layers remote from the substrate; a suitable metal coated on the first ohmic contact layer and a relatively thick layer of thermally conductive metal electroplated on the suitable metal layer, and a second ohmic contact layer on a second surface of the epitaxial layers (Fig. 15, epitaxial layers 124/126/128, first ohmic contact 150, thick layer 156, second ohmic contact 160; ¶ 0031-0050), but fails to specifically teach the suitable metal is a seed layer formed of the thermally conductive metal and furthermore an adhesive layer formed on the first ohmic contact layer between the seed layer and the first ohmic contact layer.

Held however teaches forming an adhesive layer followed by seed layer of thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee* to include an adhesive layer formed on the first ohmic contact layer and a seed layer formed on the adhesive layer made of the thermally conductive material because the seed layer and the adhesive layer helps to strengthen and ensure the metal-to-metal bond of the ohmic contact layer and the relatively thick layer. Furthermore, the seed layer also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 34, *Lee* discloses the relatively thick layer is at least 50μm (¶ 0041).

Regarding Claim 35, although *Lee*, as modified by *Held* above fails to teach the size of the ohmic contact layers, *Lee* does teach the ohmic contact layer as claimed and discloses the size of the relatively thick layer providing a scale at which the claimed range would fall in when forming a thinner ohmic contact layer. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include that the ohmic electrode could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Therefore, it would have been obvious to one having ordinary

Regarding Claim 36, although *Lee*, as modified by *Held* above fails to specifically teach the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, and includes bonding pads, *Lee* does teach in a separate embodiment an ohmic contact layer selected from a group consisting of:

opaque, transparent, and semi-transparent, and includes bonding pads (Fig. 1, ohmic contact layer 32, bonding pads 34/36; ¶ 0012). In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, and includes bonding pads because these properties of a ohmic contact layer will help improve the light emission of the device and the bonding pads will help provide strong electrical contact to the ohmic layer and to the rest of the device.

Regarding Claim 38, *Lee* discloses the thermally conductive metal is copper and the epitaxial layers comprise multiple GaN-related epitaxial layers (¶ 0032 and 0041).

Regarding Claim 39 and 51, *Lee* discloses the device is a light emitting diode (¶ 0029).

Regarding Claim 52, *Lee* teaches a light emitting diode having multiple epitaxial layers comprising an active region; a first surface of multiple epitaxial layers having a first ohmic contact layer thereon; a suitable metal coated on the first ohmic contact layer and a relatively thick layer of thermally conductive metal on the suitable metal layer, the active region being close to the relatively thick layer for improved heat transfer, but fails to specifically teach the suitable metal is a seed layer formed of the thermally conductive metal (Fig. 15, substrate 122, epitaxial layers 124/126/128, active region 126, first ohmic contact 150, thick layer 156; ¶ 0031-0050).

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee* to include a seed layer formed on the first ohmic contact of the thermally conductive material because the seed layer helps with reliability of the relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 53, *Lee* teaches the relatively thick layer is one or more selected from the group consisting of a heat sink, an electrically connector, and a mechanical support (¶ 0041).

Regarding Claim 54, *Lee* teaches a second ohmic contact layer on a second surface of the epitaxial layers (Fig. 12, ohmic electrodes 160; ¶ 0046), but fails to teach the size of the ohmic contact layers. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include that the ohmic electrodes could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such

a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

Regarding Claim 55, although, *Lee*, as modified by *Held* above fails to specifically teach the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, *Lee* does teach in a separate embodiment an ohmic contact layer selected from a group consisting of: opaque, transparent, and semi-transparent (Fig. 1, ohmic contact layer 32, bonding pads 34/36; ¶ 0012). In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent because these properties of a ohmic contact layer will help improve the light emission of the device as the light will often be emitted from the active layer towards the second ohmic contact layer.

Regarding Claim 56, *Lee* discloses the thermally conductive metal is copper and the epitaxial layers comprise multiple GaN-related epitaxial layers (¶ 0032 and 0041).

Regarding Claim 57, *Lee* discloses the device is a light emitting diode (¶ 0029).

5. Claims **40-46** are rejected under 35 U.S.C. 103(a) as being unpatentable over *Lee*, as modified by *Held* above, and further in view of *Chen et al.* **(U.S. Patent No. 6,319,778 B1**, from hereinafter "*Chen*").

Regarding Claim 40, *Lee*, as modified by *Held* above, fails to teach the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror.

Chen however teaches a light emitting device similar to that of the applicant and *Lee* above wherein the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror (Fig. 3, first ohmic contact layer 30, epitaxial layers 10-16; Col. 3, lines 26-40).

In view of the teachings of *Chen*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee*, as modified by *Held* above to include that at it's interface with the epitaxial layers the first ohmic contact layer is a mirror because this would help avoid "light absorption by the substrate and the decreasing of luminous intensity of the emitting light." (*Chen*).

Regarding Claim 41, *Lee* teaches a light emitting diode having multiple epitaxial layers and a first ohmic contact layer formed on the epitaxial layers remote from the substrate; a suitable metal coated on the first ohmic contact layer and a relatively thick layer of thermally conductive metal electroplated on the suitable metal layer, and a second ohmic contact layer on a second surface of the epitaxial layers (Fig. 15, epitaxial layers 124/126/128, first ohmic contact 150, thick layer 156, second ohmic contact 160; ¶ 0031-0050), but fails to specifically teach the suitable metal is a seed layer formed of

the thermally conductive metal and furthermore an adhesive layer formed on the first ohmic contact layer between the seed layer and the first ohmic contact layer.

Held however teaches forming an adhesive layer followed by seed layer of thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee* to include an adhesive layer formed on the first ohmic contact layer and a seed layer formed on the adhesive layer made of the thermally conductive material because the seed layer and the adhesive layer helps to strengthen and ensure the metal-to-metal bond of the ohmic contact layer and the relatively thick layer. Furthermore, the seed layer also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Lee, as modified by *Held* above, fails to teach the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror.

Chen however teaches a light emitting device similar to that of the applicant and *Lee* above wherein the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror (Fig. 3, first ohmic contact layer 30, epitaxial layers 10-16; Col. 3, lines 26-40).

In view of the teachings of *Chen*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Lee*, as

modified by *Held* above to include that at it's interface with the epitaxial layers the first ohmic contact layer is a mirror because this would help avoid "light absorption by the substrate and the decreasing of luminous intensity of the emitting light." (*Chen*).

Regarding Claim 42, *Lee* teaches the relatively thick layer is one or more selected from the group consisting of a heat sink, an electrically connector, and a mechanical support (¶ 0041).

Regarding Claim 43, *Lee* teaches a second ohmic contact layer on a second surface of the epitaxial layers (Fig. 12, ohmic electrodes 160; ¶ 0046), but fails to teach the size of the ohmic contact layers. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include that the ohmic electrodes could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

Regarding Claim 44, although, *Lee*, as modified by *Held* and *Chen* above fails to specifically teach the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, *Lee* does teach in a separate embodiment an ohmic contact layer selected from a group consisting of: opaque, transparent, and semi-transparent (Fig. 1, ohmic contact layer 32, bonding pads 34/36; ¶ 0012). In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent because these properties of a ohmic contact layer will help improve the light emission of the device as the light will often be emitted from the active layer towards the second ohmic contact layer.

Regarding Claim 45, *Lee* discloses the thermally conductive metal is copper and the epitaxial layers comprise multiple GaN-related epitaxial layers (¶ 0032 and 0041).

Regarding Claim 46, *Lee* discloses the device is a light emitting diode (¶ 0029).

Response to Arguments

6. Applicant's arguments, with respect to the rejection(s) of the claims have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made above.

7. In response to applicant's argument, with respect to claim 40, that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeremy J. Joy whose telephone number is (571)270-7445. The examiner can normally be reached on Monday - Friday, 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571)-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeremy J. Joy/
Examiner, Art Unit 2822
September 14, 2010

/Zandra V. Smith/
Supervisory Patent Examiner, Art Unit 2822